CHAPTER 3

# Polynomials (Factorisation)

## 3.1 Introduction

To express a given polynomial as the product of polynomials, each of degree less than that of given polynomial such that no such a factor has a factor of lower degree, is called factorisation.

### Standard formulae

(i) $(a + b)^2 = a^2 + 2ab + b^2$

(ii) $(a - b)^2 = a^2 - 2ab + b^2$

(iii) $(a + b)(a - b) = a^2 - b^2$

(iv) $(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$

(v) $(a + b)^2 - (a - b)^2 = 4ab$

(vi) $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca = \sum a^2 + 2\sum ab$

(vii) $(a + b)^3 = a^3 + b^3 + 3ab(a + b) = a^3 + 3a^2b + 3ab^2 + b^3$

(viii) $(a - b)^3 = a^3 - b^3 - 3ab(a - b) = a^3 - 3a^2b + 3ab^2 - b^3$

(ix) $(x + a)(x + b) = x^2 + (a + b)x + ab$

(x) $(x + a)(x + b)(x + c) = x^3 + x^2(a + b + c) + x(ab + bc + ac) + abc$

(xi) $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

(xii) $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

(xiii) $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$

(xiv) If $a + b + c = 0$, then $a^3 + b^3 + c^3 = 3abc$

(xv) $a^2 + b^2 + c^2 - ab - bc - ca = \frac{1}{2}[(a - b)^2 + (b - c)^2 + (c - a)^2]$

## 3.2 Methods of factorisation

### Factorisation by taking out the common factor

## NUMERICAL CHALLENGE 3.1

Factorise $x^3 - 3x^2 + (x - 3)$

### Solution

$x^3 - 3x^2 + (x - 3)$

$= x^2(x - 3) + 1(x - 3)$

$= (x - 3)(x^2 + 1)$

### Factorisation by grouping terms

## NUMERICAL CHALLENGE 3.2

Factorise $x^2 - ab + (a - b)x$

### Solution

$x^2 - ab + ax - bx = x^2 + ax - ab - bx$

$= x(x + a) - b(x + a) = (x + a)(x - b)$

node05\B0BO-BA\CBSE\9th\Advance\Maths-1\03_Polynomials (factorisation)\03-Theory & Exe.p65

**Factorisation by making a trinomial a perfect square**

## NUMERICAL CHALLENGE 3.3

Factorise $\left(3a-\frac{1}{b}\right)^2-6\left(3a-\frac{1}{b}\right)+9+\left(c+\frac{1}{b}-2a\right)\left(3a-\frac{1}{b}-3\right)$

**Solution**

$$\left(3a-\frac{1}{b}\right)^2-6\left(3a-\frac{1}{b}\right)+9+\left(c+\frac{1}{b}-2a\right)\left(3a-\frac{1}{b}-3\right)$$

$$=\left(3a-\frac{1}{b}\right)^2-2.3\left(3a-\frac{1}{b}\right)+3^2+\left(c+\frac{1}{b}-2a\right)\left(3a-\frac{1}{b}-3\right)$$

$$=\left(3a-\frac{1}{b}-3\right)^2+\left(c+\frac{1}{b}-2a\right)\left(3a-\frac{1}{b}-3\right)$$

$$=\left(3a-\frac{1}{b}-3\right)\left(3a-\frac{1}{b}-3+c+\frac{1}{b}-2a\right)$$

$$=\left(3a-\frac{1}{b}-3\right)(a+c-3)$$

**Factorisation by using the formula $a^2 - b^2 = (a + b)(a - b)$**

## NUMERICAL CHALLENGE 3.4

Factorise (i) $4x^2+\frac{1}{4x^2}+2-9y^2$ (ii) $a^4+\frac{1}{a^4}-3$

**Solution**

(i) $4x^2+\frac{1}{4x^2}+2-9y^2$

$$=(2x)^2+2.(2x).\left(\frac{1}{2x}\right)+\left(\frac{1}{2x}\right)^2-(3y)^2$$

$$=\left(2x+\frac{1}{2x}\right)^2-(3y)^2$$

$$=\left(2x+\frac{1}{2x}+3y\right)\left(2x+\frac{1}{2x}-3y\right)$$

(ii) $(a^2)^2+\left(\frac{1}{a^2}\right)^2-2.(a^2).\left(\frac{1}{a^2}\right)-1$

$$=\left(a^2-\frac{1}{a^2}\right)^2-(1)^2=\left(a^2-\frac{1}{a^2}+1\right)\left(a^2-\frac{1}{a^2}-1\right)$$

ALLEN

node05\B0B0-BA\CBSE\9th\Advance\Maths-1\03_Polynomials (factorisation)\03-Theory & Exe.p65

**Factorisation by using the formula of $a^3 + b^3$ and $a^3 - b^3$**

## NUMERICAL CHALLENGE 3.5

Factorise $p^3q^2x^4 + 3p^2qx^3 + 3px^2 + \frac{x}{q} - q^2r^3x$

### Solution

$p^3q^2x^4 + 3p^2qx^3 + 3px^2 + \frac{x}{q} - q^2r^3x$

$= \frac{x}{q}(p^3q^3x^3 + 3p^2q^2x^2 + 3pqx + 1 - q^3r^3)$

$= \frac{x}{q}[(pqx)^3 + 3(pqx)^2.1 + 3pqx.\ (1)^2 + (1)^3 - q^3r^3]$

Let $pqx = A$ & $1 = B$

$= \frac{x}{q}(A^3 + 3A^2B + 3AB^2 + B^3 - q^3r^3)$

$= \frac{x}{q}[(pqx + 1)^3 - (qr)^3]$

$= \frac{x}{q}(pqx + 1 - qr)[(pqx + 1)^2 + (pqx + 1)\ qr + (qr)^2]$

$= \frac{x}{q}(pqx + 1 - qr)[(p^2q^2x^2 + 1 + 2pqx + pq^2xr + qr + q^2r^2]$

## NUMERICAL CHALLENGE 3.6

Factorise (i) $a^3 + b^3 + c^3 - 3abc$ (ii) $a^6 + 4a^3 - 1$ (iii) $(a^2 - b^2)^3 + (b^2 - c^2)^3 + (c^2 - a^2)^3$

### Solution

(i) $(a^3 + b^3) + c^3 - 3abc = (a + b)^3 - 3ab(a + b) + c^3 - 3abc$

$= [(a + b)^3 + c^3] - [3ab\ (a + b) + 3abc]$

$= (a + b + c)[(a + b)^2 + c^2 - (a + b)c] - [3ab(a + b + c)]$

$= (a + b + c)(a^2 + b^2 + 2ab + c^2 - ac - bc - 3ab)$

$= (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$

(ii) $a^6 + a^3 + 3a^3 - 1$

$= (a^2)^3 + (a)^3 + (-1)^3 - 3(a^2)(a)(-1)$

$= (a^2 + a - 1)(a^4 + a^2 + 1 + a^2 + a - a^3)$

$= (a^2 + a - 1)(a^4 - a^3 + 2a^2 + a + 1)$

(iii) Let $A = a^2 - b^2$, $B = b^2 - c^2$ & $C = c^2 - a^2$

$A^3 + B^3 + C^3 = 3\ ABC$, if $A + B + C = 0$

$\therefore\ a^2 - b^2 + b^2 - c^2 + c^2 - a^2 = 0$

$\therefore\ (a^2 - b^2)^3 + (b^2 - c^2)^3 + (c^2 - a^2)^3$

$= 3(a^2 - b^2)\ (b^2 - c^2)\ (c^2 - a^2)$

$= 3(a + b)\ (a - b)\ (b + c)\ (b - c)\ (c + a)\ (c - a)$

node05\B0BO-BA\CBSE\9th\Advance\Maths-1\03_Polynomials (factorisation)\03-Theory & Exe.p65

## 3.3 Factorisation of a quadratic polynomial

In the form of $ax^2 + bx + c$ where $a \neq 0$, firstly take common 'a' in the whole expression, then factorise by converting the expression $a\left(x^2 + \frac{b}{a}x + \frac{c}{a}\right)$ as the difference of two squares.

## NUMERICAL CHALLENGE 3.7

Factorise (i) $x^2 - 31x + 220$ (ii) $-10x^2 + 31x - 24$

**Solution**

(i) $x^2 - 2.\frac{31}{2}.x + \left(\frac{31}{2}\right)^2 - \left(\frac{31}{2}\right)^2 + 220$

$= \left(x - \frac{31}{2}\right)^2 - \frac{961}{4} + 220 = \left(x - \frac{31}{2}\right)^2 - \frac{81}{4}$

$= \left(x - \frac{31}{2}\right)^2 - \left(\frac{9}{2}\right)^2 = \left(x - \frac{31}{2} + \frac{9}{2}\right)\left(x - \frac{31}{2} - \frac{9}{2}\right)$

$= (x - 11)(x - 20)$

(ii) $-(10x^2 - 31x + 24) = -10\left(x^2 - \frac{31}{10}x + \frac{24}{10}\right)$

$= -10\left[x^2 - 2.\frac{31}{20}.x + \left(\frac{31}{20}\right)^2 - \left(\frac{31}{20}\right)^2 + \frac{24}{10}\right]$

$= -10\left[\left(x - \frac{31}{20}\right)^2 - \frac{1}{400}\right]$

$= -10\left[\left(x - \frac{31}{20}\right)^2 - \left(\frac{1}{20}\right)^2\right] = -10\left(x - \frac{31}{20} + \frac{1}{20}\right)\left(x - \frac{31}{20} - \frac{1}{20}\right)$

$= -10\left(\frac{2x - 3}{2}\right)\left(\frac{5x - 8}{5}\right) = -(2x - 3)(5x - 8) = (3 - 2x)(5x - 8)$

ALLEN

node05\B0B0-BA\CBSE\9th\Advance\Maths-1\03_Polynomials (factorisation)\03-Theory & Exe.p65

## 3.4 Square roots

There are three methods of finding square roots of algebraic expressions which are not monomials.

(i) Inspection (ii) Division (iii) Undetermined coefficients method

### Inspection method

## NUMERICAL CHALLENGE 3.8

Find the square root of $a^2 - 2ax + x^2 + 2a - 2x + 1$

### Solution

$(a)^2 + (x)^2 + (1)^2 - 2ax - 2x + 2a$

$= (a - x + 1)^2$

The required square root is $(a - x + 1)$

### Division method

## NUMERICAL CHALLENGE 3.9

Find the square root of $x^4 - 2x^3 + 3x^2 - 2x + 1$ by using division method.

### Solution

$x^2$ | $x^4 - 2x^3 + 3x^2 - 2x + 1$ | $x^2 - x + 1$

$x^4$

$2x^2 - x$ | $-2x^3 + 3x^2$ | $[x^2 \times 2$ or $x^2 + x^2]$

$-2x^3 + x^2$

$+ \quad -$

$2x^2 - 2x + 1$ | $2x^2 - 2x + 1$ | $[(x^2 - x)\,2$ or $2x^2 - x - x]$

$2x^2 - 2x + 1$

$- \quad + \quad -$

$0$

$\therefore$ The required square root is $(x^2 - x + 1)$

### Undetermined coefficients method

## NUMERICAL CHALLENGE 3.10

Find the square root of $a^2 - 2ax + x^2 + 2a - 2x + 1$.

### Solution

The given expression being of degree 2, its square root will be a linear expression and having 6 terms and hence a trinomial.

Let $(a^2 - 2ax + x^2 + 2a - 2x + 1) = (a + px + q)^2$

$(a + px + q)^2 = a^2 + p^2x^2 + q^2 + 2apx + 2aq + 2pqx$

thus,

$a^2 - 2ax + x^2 + 2a - 2x + 1 = a^2 + p^2x^2 + 2px(a + q) + 2aq + q^2$

Comparing the coefficients of powers of x on either side,

we get,

$1 = p^2$, $2a + 1 = 2aq + q^2$

$p = \pm 1$, $2a + 1 = q(2a + 1)$

p can't be positive so $p = -1$ and $q = 1$

$\therefore$ The square root is $(a + px + q) = (a - x + 1)$

node05\B0BO-BA\CBSE\9th\Advance\Maths-1\03_Polynomials (factorisation)\03-Theory & Exe.p65

## NUMERICAL CHALLENGE 3.11

If $x + \frac{1}{x} = 7$, then find the value of (i) $x^2 + \frac{1}{x^2}$ (ii) $x^4 + \frac{1}{x^4}$

**Solution**

(i) $x + \frac{1}{x} = 7$

Squaring on both sides, we get

$\left(x + \frac{1}{x}\right)^2 = (7)^2$

$\Rightarrow x^2 + \frac{1}{x^2} + 2 \times x \times \frac{1}{x} = 49 \quad \Rightarrow x^2 + \frac{1}{x^2} = 47$

(ii) Squaring on both sides, we get

$\left(x^2 + \frac{1}{x^2}\right)^2 = (47)^2$

$\Rightarrow (x^2)^2 + \left(\frac{1}{x^2}\right)^2 + 2 \times x^2 \times \frac{1}{x^2} = 2209$

$\Rightarrow x^4 + \frac{1}{x^4} + 2 = 2209$

$\Rightarrow x^4 + \frac{1}{x^4} = 2207$

## NUMERICAL CHALLENGE 3.12

If $(2a + b) = 12$ and $ab = 15$, then find the value of $8a^3 + b^3$.

**Solution**

$(2a + b) = 12$

Cubing both sides, we get

$(2a + b)^3 = (12)^3$

$\Rightarrow (2a)^3 + b^3 + 3 \times 2a \times b(2a + b) = 1728$

$\Rightarrow 8a^3 + b^3 + 3 \times 2 \times 15(12) = 1728$ [Substituting $ab = 15$ and $(2a + b) = 12$]

$\Rightarrow 8a^3 + b^3 + 1080 = 1728$

$\Rightarrow 8a^3 + b^3 = 1728 - 1080 = 648$

## NUMERICAL CHALLENGE 3.13

Find the products (i) $(2x + 3y)(4x^2 - 6xy + 9y^2)$ (ii) $(5x - 3y)(25x^2 + 15xy + 9y^2)$

**Solution**

(i) $(2x + 3y)(4x^2 - 6xy + 9y^2)$

$= (2x + 3y)[(2x)^2 - (2x) \times (3y) + (3y)^2]$

This is of the form $(a + b)(a^2 - ab + b^2)$, where $a = 2x$ and $b = 3y$

we have, $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

$= (2x)^3 + (3y)^3 = 8x^3 + 27y^3$

(ii) $(5x - 3y)(25x^2 + 15xy + 9y^2)$

$= (5x - 3y)[(5x)^2 + (5x) \times (3y) + (3y)^2]$

This is of the form $(a - b)(a^2 + ab + b^2)$ where $a = 5x$ and $b = 3y$

we have, $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

$= (5x)^3 - (3y)^3 = 125x^3 - 27y^3$

ALLEN

node05\B0B0-BA\CBSE\9th\Advance\Maths-1\03_Polynomials (factorisation)\03-Theory & Exe.p65

## NUMERICAL CHALLENGE 3.14

Factorise

(i) $9x^2 - 16y^2$ (ii) $5x^2 - 9y^2$

(iii) $x^2 + 4y^2 - 9z^2 - 4xy$ (iv) $16 - a^4$

**Solution**

(i) $9x^2 - 16y^2 = (3x)^2 - (4y)^2 = (3x + 4y)(3x - 4y)$

(ii) $5x^2 - 9y^2 = \left(\sqrt{5}x\right)^2 - (3y)^2 = \left(\sqrt{5}x + 3y\right)\left(\sqrt{5}x - 3y\right)$

(iii) $x^2 + 4y^2 - 9z^2 - 4xy$

$= x^2 - 4xy + 4y^2 - 9z^2$

$= (x - 2y)^2 - (3z)^2$

$= (x - 2y + 3z)(x - 2y - 3z)$

(iv) $16 - a^4 = (4)^2 - (a^2)^2$

$= (4 + a^2)(4 - a^2)$ [since, $4 - a^2$ can be factorised again]

$= (4 + a^2)(2 + a)(2 - a)$

## NUMERICAL CHALLENGE 3.15

Factorise the following

(i) $4x^2 + 9y^2 + 16z^2 + 12xy + 24yz + 16xz$

(ii) $9x^2 + y^2 + 4z^2 + 6xy - 4yz - 12xz$

**Solution**

(i) $4x^2 + 9y^2 + 16z^2 + 12xy + 24yz + 16xz$

$= (2x)^2 + (3y)^2 + (4z)^2 + 2 \times 2x \times 3y + 2 \times 3y \times 4z + 2 \times 2x \times 4z$

$= (2x + 3y + 4z)^2$

(ii) $9x^2 + y^2 + 4z^2 + 6xy - 4yz - 12xz$

$= (3x)^2 + (y)^2 + (-2z)^2 + 2 \times 3x \times y + 2 \times y \times (-2z) + 2 \times 3x \times (-2z)$

$= (3x + y - 2z)^2$

## NUMERICAL CHALLENGE 3.16

If $x = \sqrt{7} - \sqrt{5}$, $y = \sqrt{5} - \sqrt{3}$, $z = \sqrt{3} - \sqrt{7}$, then find the value of $x^3 + y^3 + z^3 - 2xyz$.

**Solution**

$x + y + z = \sqrt{7} - \sqrt{5} + \sqrt{5} - \sqrt{3} + \sqrt{3} - \sqrt{7} = 0$

$\Rightarrow x + y + z = 0$

$\therefore x^3 + y^3 + z^3 = 3xyz$

$\Rightarrow x^3 + y^3 + z^3 - 2xyz = 3xyz - 2xyz$

$\Rightarrow x^3 + y^3 + z^3 - 2xyz = xyz$

$\Rightarrow x^3 + y^3 + z^3 - 2xyz = (\sqrt{7} - \sqrt{5})(\sqrt{5} - \sqrt{3})(\sqrt{3} - \sqrt{7})$

$= (\sqrt{35} - \sqrt{21} - 5 + \sqrt{15})(\sqrt{3} - \sqrt{7})$

$= \sqrt{105} - 7\sqrt{5} - 3\sqrt{7} - 7\sqrt{3} - 5\sqrt{3} + 5\sqrt{7} + 3\sqrt{5} - \sqrt{105}$

$= -4\sqrt{5} + 2\sqrt{3} + 2\sqrt{7}$

ALLEN

## NUMERICAL CHALLENGE 3.17

If $a + b + c = 0$, then prove that $\frac{a^2}{bc}+\frac{b^2}{ca}+\frac{c^2}{ab}=3$.

### Solution

If $a + b + c = 0$, then $a^3 + b^3 + c^3 = 3abc$

Dividing throughout by abc, we get $\frac{a^3}{abc}+\frac{b^3}{abc}+\frac{c^3}{abc}=3$

$\Rightarrow \frac{a^2}{bc}+\frac{b^2}{ca}+\frac{c^2}{ab}=3$

## NUMERICAL CHALLENGE 3.18

Simplify: $\frac{(a^2-b^2)^3+(b^2-c^2)^3+(c^2-a^2)^3}{(a-b)^3+(b-c)^3+(c-a)^3}$

### Solution

We have, $(a^2 - b^2) + (b^2 - c^2) + (c^2 - a^2) = 0$

$\therefore (a^2 - b^2)^3 + (b^2 - c^2)^3 + (c^2 - a^2)^3 = 3(a^2 - b^2)(b^2 - c^2)(c^2 - a^2)$

[since, If $x + y + z = 0$, then $x^3 + y^3 + z^3 = 3xyz$]

$= 3(a - b)(a + b)(b - c)(b + c)(c - a)(c + a)$

Similarly,

$(a - b) + (b - c) + (c - a) = 0$

$\Rightarrow (a - b)^3 + (b - c)^3 + (c - a)^3 = 3(a - b)(b - c)(c - a)$

$\therefore \frac{(a^2-b^2)^3+(b^2-c^2)^3+(c^2-a^2)^3}{(a-b)^3+(b-c)^3+(c-a)^3}$

$= \frac{3(a-b)(a+b)(b+c)(c-a)(c+a)}{3(a-b)(b-c)(c-a)}$

$= (a + b)(b + c)(c + a)$

## NUMERICAL CHALLENGE 3.19

Show that $(3a + 2b - c + d)^2 - 12a(2b - c + d)$ is a perfect square.

### Solution

$(3a + 2b - c + d)^2 - 12a(2b - c + d)$

$= [3a + (2b - c + d)]^2 - 4(3a)(2b - c + d)$

This is of the form $(A + B)^2 - 4AB$,

where $A = 3a$ and $B = 2b - c + d$

we have, $(A - B)^2 = (A + B)^2 - 4AB$

$= (3a - 2b + c - d)^2$

$\therefore$ The given expression is a perfect square.

ALLEN

ncle05\B080-BA\CBSE\9th\Advance\Maths-1\03_Polynomials (factorisation)\03-Theory & Exe.p65

## NUMERICAL CHALLENGE 3.20

Find the square root of $(ab - ac - bc)^2 + 4abc(a + b)$

**Solution**

$(ab - ac - bc)^2 + 4abc\,(a + b)$

$= (ab - c(a + b))^2 + 4(ab)\,(c(a + b))$

This is of the form $(A + B)^2 - 4AB$

where $A = ab$ and $B = -c(a + b)$

$= (ab + bc + ca)^2$

$\therefore$ The square root is $ab + bc + ca$.

## NUMERICAL CHALLENGE 3.21

Show that $(x + 1)(x + 2)(x + 3)(x + 4) + 1$ is a perfect square.

**Solution**

$(x + 1)(x + 2)(x + 3)(x + 4) + 1$

$= (x + 1)(x + 4)(x + 2)(x + 3) + 1$

$= (x^2 + 5x + 4)(x^2 + 5x + 6) + 1$

Write $x^2 + 5x + 4 = a$ then the given expression will become

$= a(a + 2) + 1$

$= a^2 + 2a + 1$

$= (a + 1)^2$

$= (x^2 + 5x + 4 + 1)^2$ (since, $a = x^2 + 5x + 4$)

$= (x^2 + 5x + 5)^2$

Hence, the given expression is a perfect square.

## NUMERICAL CHALLENGE 3.22

If $ax^2 + bx + c$ is a perfect square, then prove that $b^2 = 4ac$

**Solution**

Let $ax^2 + bx + c = (\ell x + m)^2$

then $ax^2 + bx + c = \ell^2 x^2 + 2\ell mx + m^2$

Comparing coefficients of various powers of x on either side

we get $\ell^2 = a$

$2\ell m = b$, $m^2 = c$

$4\ell^2 m^2 = b^2$

Eliminating $\ell$, m

i.e., $4ac = b^2$

$\therefore$ $b^2 = 4ac$

Hence proved.

node05\B0BO-BA\CBSE\9th\Advance\Maths-1\03_Polynomials (factorisation)\03-Theory & Exe.p65

## EXERCISE

### Multiple choice questions

**1.** If $x + \frac{1}{x} = 5$, then the value of $x^3 + \frac{1}{x^3}$ is

(1) 110 (2) 90 (3) 80 (4) 50

**2.** If $x^3 - (x + 1)^2 = 2001$ then the value of x is

(1) 14 (2) 13 (3) 10 (4) None of these

**3.** The square root of $\frac{x^2}{y^2}+\frac{y^2}{4x^2}-\frac{x}{y}+\frac{y}{2x}-\frac{3}{4}$ is

(1) $\frac{x}{y}-\frac{1}{2}-\frac{y}{2x}$ (2) $\frac{x}{y}+\frac{1}{2}-\frac{y}{2x}$ (3) $\frac{x}{y}+\frac{1}{2}+\frac{y}{2x}$ (4) $\frac{x}{y}-\frac{1}{4}-\frac{y}{2x}$

**4.** On simplifying $(a + b)^3 + (a - b)^3 + 6a(a^2 - b^2)$ we get

(1) $8a^2$ (2) $8a^2b$ (3) $8a^3b$ (4) $8a^3$

**5.** Factors of $(42 - x - x^2)$ are

(1) $(x - 7)(x - 6)$ (2) $(x + 7)(x - 6)$ (3) $(x + 7)(6 - x)$ (4) $(x + 7)(x + 6)$

**6.** Factors of $\left(x^2+\frac{x}{6}-\frac{1}{6}\right)$ are

(1) $\frac{1}{6}(2x+1)(3x+1)$ (2) $\frac{1}{6}(2x+1)(3x-1)$ (3) $\frac{1}{6}(2x-1)(3x-1)$ (4) $\frac{1}{6}(2x-1)(3x+1)$

**7.** Value of $\frac{a^3+b^3+c^3-3abc}{ab+bc+ca-a^2-b^2-c^2}$, when $a = -5$, $b = -6$, $c = 10$ is

(1) 1 (2) –1 (3) 2 (4) –2

**8.** If $(x + y + z) = 1$, $xy + yz + zx = -1$, $xyz = -1$, then the value of $x^3 + y^3 + z^3$ is

(1) –1 (2) 1 (3) 2 (4) –2

**9.** In method of factorisation of an algebraic expression, which of the following statements is false?

(1) Taking out a common factor from two or more terms

(2) Taking out a common factor from a group of terms

(3) By using remainder theorem

(4) By using standard identities

**10.** Factors of $(a + b)^3 - (a - b)^3$ are

(1) $2ab(3a^2 + b^2)$ (2) $ab(3a^2 + b^2)$ (3) $2b(3a^2 + b^2)$ (4) $3a^2 + b^{20}$

**11.** The HCF of the functions

$x^3 + (a + b)x^2 + (ab + 1)x + b$ and $x^3 + 2ax^2 + (a^2 + 1)x + a$ is

(1) $x^2 + ax + 1$ (2) $x^2 + bx + 1$ (3) $x^2 + x + a$ (4) $x^2 + x + b$

ALLEN

node05\B0B0-BA\CBSE\9th\Advance\Maths-1\03_Polynomials (factorisation)\03-Theory & Exe.p65

**12.** If the polynomial $16x^4 - 24x^3 + 41x^2 - mx + 16$ be a perfect square,then the value of "m" is

(1) 12 (2) –12 (3) 24 (4) –24

**13.** If $abx^2 = (a - b)^2(x + 1)$, then the value of $1 + \frac{4}{x} + \frac{4}{x^2}$ is

(1) $\left(\frac{a-b}{a+b}\right)^2$ (2) $\left(\frac{a+b}{a-b}\right)^2$ (3) $\left(\frac{a}{a+b}\right)^2$ (4) $\left(\frac{b}{a+b}\right)^2$

**14.** The GCD of $x^2 - 3x + 2$ and $x^2 - 4x + 4$ is

(1) $x - 2$ (2) $(x - 2)(x - 1)$ (3) $(x - 2)^2$ (4) $(x - 2)^3(x - 1)$

**15.** The LCM of $22x(x + 1)^2$ and $36x^2(2x^2 + 3x + 1)$ is

(1) $2x(x + 1)$ (2) $396x^2(x + 1)^2(2x + 1)$

(3) $792x^3(x + 1)^2 (2x^2 + 3x + 1)$ (4) None of these

**16.** The LCM of $x^3 - 8$ and $x^2 - 5x + 6$ is

(1) $x - 2$ (2) $x^2 + 2x + 4$

(3) $(x - 2)(x^2 + 2x + 4 )$ (4) $(x -2)(x - 3)(x^2 + 2x + 4)$

**17.** If the GCD of the polynomials $x^3 - 3x^2 + px + 24$ and $x^2 -7x + q$ is $(x - 2)$, then the value of $(p + q)$ is

(1) 0 (2) 20 (3) –20 (4) 40

**18.** The LCM of two polynomials p(x) and q(x) is $(x + 3)(x - 2)^2(x - 6)$ and their HCF is $(x - 2)$.If $p(x) = (x + 3)(x - 2)^2$, then q(x) =

(1) $(x + 3)((x - 2)$ (2) $x^2 - 3x - 18$ (3) $x^2 - 8x + 12$ (4) none of these

**19.** The GCD of two polynomials is $(x - 1)$ and their LCM is $x^6 - 1$. If one of the polynomials is $x^3 - 1$, then the other polynomial is

(1) $x^3 - 1$ (2) $x^4 - x^3 + x - 1$ (3) $x^2 - x + 1$ (4) None of these

**20.** The LCM of $2x$ and 8 is

(1) $2x$ (2) $4x$ (3) $8x$ (4) $16x$

**21.** If $x^2 + \frac{1}{x^2} = 38$, then the value of $x - \frac{1}{x}$ is

(1) 6 (2) 4 (3) 0 (4) None of these

**22.** The simplest form of $(2x + 3)^3 - (2x - 3)^3$ is

(1) $54 + 72x^2$ (2) $72 + 54x^2$ (3) $54 + 54x^2$ (4) None of these

**23.** The simplest form of $(p - q)^3 + (q - r)^3 + (r - p)^3$ is

(1) $4(p - q)(q - r)(r - p)$ (2) $2(p - q)(q - r)(r - p)$

(3) $3(p - q)(q - r)(r - p)$ (4) None of these

**24.** The square root of $x^4 + 6x^3 + 17x^2 + 24x + 16$ is

(1) $x^2 + 3x + 4$ (2) $2x^2 + 3x + 4$ (3) $3x^2 + 3x + 4$ (4) None of these

node05\B0BO-BA\CBSE\9th\Advance\Maths-1\03_Polynomials (factorisation)\03-Theory & Exe.p65

**25.** $p(x) = \sqrt{3}x^2 + 11x + 6\sqrt{3}$ is same as

(1) $(x + 3\sqrt{3})(\sqrt{3}x + 2)$ (2) $(x - 3\sqrt{3})(\sqrt{3}x + 2)$ (3) $(x - 3\sqrt{3})(\sqrt{3}x - 2)$ (4) $(x - 3\sqrt{3})(\sqrt{3}x + 2)$

ALLEN

## ANSWERS

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | 1 | 2 | 1 | 4 | 3 | 2 | 1 | 2 | 3 | 3 | 1 | 3 | 2 | 1 | 2 |
| Que. | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | | | | | |
| Ans. | 4 | 1 | 3 | 2 | 3 | 1 | 1 | 3 | 1 | 1 | | | | | |

node05\B0BO-BA\CBSE\9th\Advance\Maths-1\03_Polynomials (factorisation)\03-Theory & Exe.p65